

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A photon emitter comprising:

a photon generator configured to generate randomly polarized photons separable into a first polarisation state and a second polarisation state, the first polarisation state being orthogonal to the second polarisation state;

time delay means receiving said randomly polarized photons and being configured to delay photons having the second polarisation state with respect to those having the first polarisation state such that photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with the second polarization;

encoding means, wherein photons which have passed through the time delay means are passed into an encoding means,

wherein said encoding means are configured to encode the phase of a photon and comprise a first interferometer, said first interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having first phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values,

wherein the photons are received by a receiver, and the receiver comprises a second interferometer, the second interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having second phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values; and

further comprising directing means configured to ensure that photons which have passed through the short arm of the first interferometer are directed down the long arm of the

second interferometer and photons which have passed through the long arm of the first interferometer pass through the short arm of the second interferometer,

wherein the directing means comprises first polarising means configured to allow photons which have travelled through different arms of the first interferometer different polarisations and second polarising means which distinguish between the photons having different polarisations and direct them down the appropriate arm of the second interferometer.

Claim 2 (Original): A photon emitter according to claim 1, wherein the time delay means comprises a polarising beamsplitter which directs photons having the first polarisation state along a first path and photons having the second polarisation state along a second path and combining means to combine the first and second paths, one of the paths being longer than the other path.

Claim 3 (Original): A photon emitter according to claim 2, wherein one of the paths is provided with means to rotate the polarisation of photons passing through said path such that photons from the first path and the second path at the combining means have the same polarisation.

Claim 4 (Original): A photon emitter according to claim 1, wherein the time delay means comprises a single path configured to allow photons having a first polarisation state to travel at a different speed to photons with a second polarisation state.

Claim 5 (Canceled)

Claim 6 (Previously Presented): A photon emitter according to claim 1, wherein the encoding means is capable of performing a different encoding operation on photons with the first polarisation state than those with the second polarisation state.

Claim 7 (Canceled)

Claim 8 (Currently Amended): A photon emitter according to claim 1, wherein the time delay means comprises a polarising beamsplitter which directs photons having the first polarisation state along a first path and photons having the second polarisation state along a second path and combining means to combine the first and second paths, one of the paths being longer than the other path and wherein said entrance coupler has first and second inputs and first and second outputs, wherein the first and second outputs are connected to the long arm and short arm of the first interferometer, and photons which pass through the first path and second path are coupled into the same input of the entrance coupler.

Claim 9 (Currently Amended): A photon emitter according to claim 8, wherein said further comprising a phase modulator [[is]] capable of providing a different modulation to photons which pass through the first path than those which pass through the second path, such that photons generated with the first or second polarisation state exit the interferometer with the same phase state.

Claim 10 (Currently Amended): A photon emitter according to claim 1, wherein the time delay means comprises a polarising beamsplitter which directs photons having the first polarisation state along a first path and photons having the second polarisation state along a second path and combining means to combine the first and second paths, one of the paths

being longer than the other path and wherein said entrance coupler has first and second inputs and first and second outputs connected, wherein said first and second outputs are connected to said long arm and short arm of the first interferometer, and said entrance coupler also provides the combining means for the first path and the second path such that photons which follow the first path enter the entrance coupler by the first input and photons which follow the second path enter the entrance coupler by the second input.

Claim 11 (Canceled).

Claim 12 (Canceled).

Claim 13 (Original): A photon emitter according to claim 1, further comprising means to rotate the polarisation of the delayed photons by 90°, such that photons are emitted having the same polarisation.

Claim 14 (Previously Presented): A quantum communication system comprising:
a photon emitter comprising:

a photon generator configured to generate randomly polarized photons separable into a first polarisation state and a second polarisation state the first polarisation state being orthogonal to the second polarisation state;

time delay means receiving said randomly polarized photons being configured to delay photons having the second polarisation state with respect to those having the first polarisation state; and

encoding means, wherein photons which have passed through the time delay means are passed into an encoding means,

the communication system further comprising a receiver having means to decode the photons and a detector,

wherein photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with a second polarisation and photons with the first polarisation are temporally separated from photons with the second polarisation when entering the encoding means,

wherein said encoding means are configured to encode the phase of a photon and comprise a first interferometer, said interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having first phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values, the receiver comprising a second interferometer, the second interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having second phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values; and

the quantum communication system further comprising directing means configured to ensure that photons which have passed through the short arm of the first interferometer are directed down the long arm of the second interferometer and photons which have passed through the long arm of the first interferometer pass through the short arm of the second interferometer,

wherein the directing means comprises first polarising means configured to allow photons which have travelled through different arms of the first interferometer different polarisations and second polarising means which distinguish between the photons having

different polarisations and direct them down the appropriate arm of the second interferometer.

Claim 15-17 (Canceled).

Claim 18 (Previously Presented): A system comprising:

a photon emitter comprising:

a photon generator configured to generate randomly polarized photons separable into a first polarisation state and a second polarisation state the first polarisation state being orthogonal to the second polarisation state;

time delay means receiving said randomly polarized photons being configured to delay photons having the second polarisation state with respect to those having the first polarisation state; and

encoding means, wherein photons which have passed through the time delay means are passed into an encoding means,

the communication system further comprising a receiver having means to decode the photons and a detector,

wherein photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with a second polarisation and photons with the first polarisation are temporally separated from photons with the second polarisation when entering the encoding means,

wherein said encoding means are configured to encode the phase of a photon and comprise a first interferometer, said interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having first phase variation means which allows the phase

of a photon passing through that arm to be set to one of at least two values, the receiver comprising a second interferometer, the second interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having second phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values; and

means to vary the path length of one of the arms of at least one of the interferometers such that photon pulses which take the short arm of first interferometer and the long arm of the second interferometer take the same time to pass through both interferometers as photon pulses which pass through the long arm of the first interferometer and the short arm of the second interferometer.

Claim 19 (Original): A quantum communication system according to claim 14, further comprising means to apply a gating signal to the detector, said gating signal being provided to switch the detector between an 'on mode' where photons may be detected and an 'off mode' where photons may not be detected.

Claim 20 (Previously Presented): A quantum communication system comprising:
a photon emitter comprising:

a photon generator configured to generate randomly polarized photons separable into a first polarisation state and a second polarisation state the first polarisation state being orthogonal to the second polarisation state;

time delay means receiving said randomly polarized photons being configured to delay photons having the second polarisation state with respect to those having the first polarisation state; and

encoding means, wherein photons which have passed through the time delay means are passed into an encoding means,

the communication system further comprising a receiver having means to decode the photons and a detector,

wherein photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with a second polarisation and photons with the first polarisation are temporally separated from photons with the second polarisation when entering the encoding means; and

means to apply a gating signal to the detector, said gating signal being provided to switch the detector between an 'on mode' where photons may be detected and an 'off mode' where photons may not be detected,

wherein the detector is in an 'on mode' from the time when it expects to receive a photon which has followed the shortest path through the time delay means until and including the time when it expects to receive a photon which has followed the longest path through the time delay means.

Claim 21 (Original): A quantum communication system according to claim 19, wherein the detector is in an "on mode" for the two intervals when a photon is expected after following the first or second path in the time delay means.

Claim 22 (Previously Presented): A quantum communication system comprising:
a photon emitter comprising:

a photon generator configured to generate randomly polarized photons separable into a first polarisation state and a second polarisation state the first polarisation state being orthogonal to the second polarisation state;

time delay means receiving said randomly polarized photons being configured to delay photons having the second polarisation state with respect to those having the first polarisation state; and

encoding means, wherein photons which have passed through the time delay means are passed into an encoding means,

the communication system further comprising a receiver having means to decode the photons and a detector,

wherein photons which enter the time delay means with the first polarisation exit the time delay means at a different time to photons which enter the time delay means with a second polarisation and photons with the first polarisation are temporally separated from photons with the second polarisation when entering the encoding means,

wherein said encoding means are configured to encode the phase of a photon and comprise a first interferometer, said interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having first phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values, the receiver comprising a second interferometer, the second interferometer comprising an entrance coupler connected to a long arm and a short arm, said long arm and short arm being joined at their other ends by an exit coupler, one of said arms having second phase variation means which allows the phase of a photon passing through that arm to be set to one of at least two values; and

further comprising means to apply a gating signal to the detector, said gating signal being provided to switch the detector between an 'on mode' where photons may be detected and an 'off mode' where photons may not be detected wherein the detector is in an off mode

when it expects to receive photons which have passed through either the long arms of both interferometers or the short arms of both interferometers.

Claim 23 (Original): A system according to claim 14, further comprising means to communicate a clock signal between emitter and receiver.

Claim 24 (Original): A system according to claim 14, wherein a clock pulse is sent from the emitter to the receiver with each photon from the generator.

Claim 25 (Original): A system according to claim 24, wherein the clock signal has a different wavelength to the photons emitted from the photon generator.

Claim 26 (Original): A system according to claim 24, wherein the clock signal has a different polarisation to that of the photons sent to the receiver from the photon generator.

Claims 27 – 31 (Canceled).

Claim 32 (Previously Presented): A photon emitter according to claim 1, wherein the photon generator comprises a single photon source.

Claim 33 (Previously Presented): A photon emitter according to claim 32, wherein the single photon source emits a single photon pulse having a duration in a range of 100 ps to 1 ns.

Claims 34 -35 (Canceled).